



Arup

**Cwm Clydach Culvert – Hydraulic Modelling Dimensional and
Constructional Survey**

10th March 2022

Contents Amendment Record


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Date of Inspection	07/01/2020	Lead Inspector	N.Tucker	

1 Introduction

1.1 Location

Cwm Clydach Culvert carries Nant Clydach beneath the A4119 between grid references SS 98336 92776 and SS 99306 92685; please see location plans below in *Figure 1* and *Figure 2*.

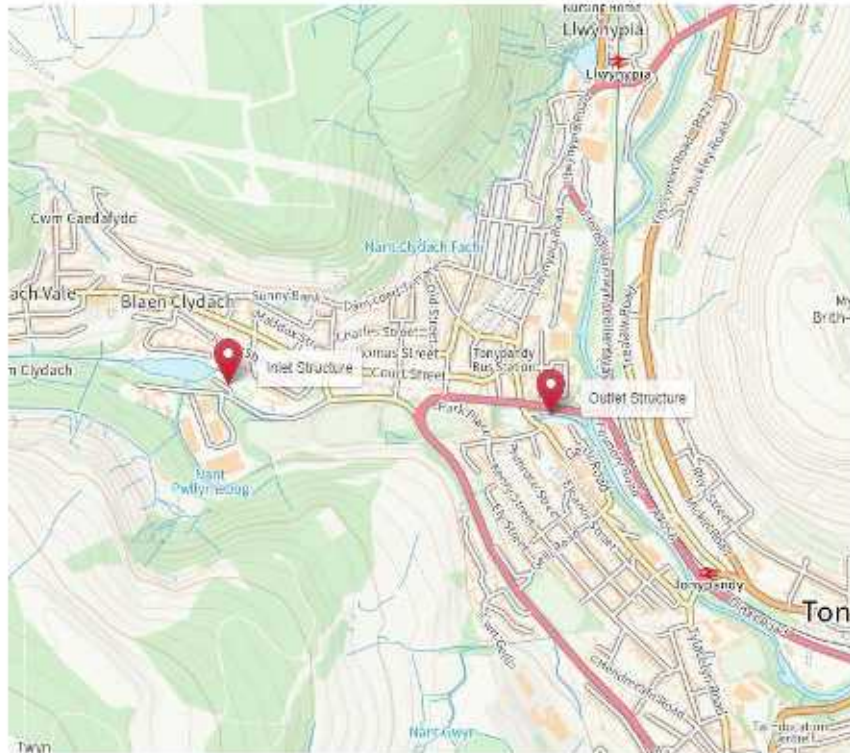


Figure 1: Structure Location Plan

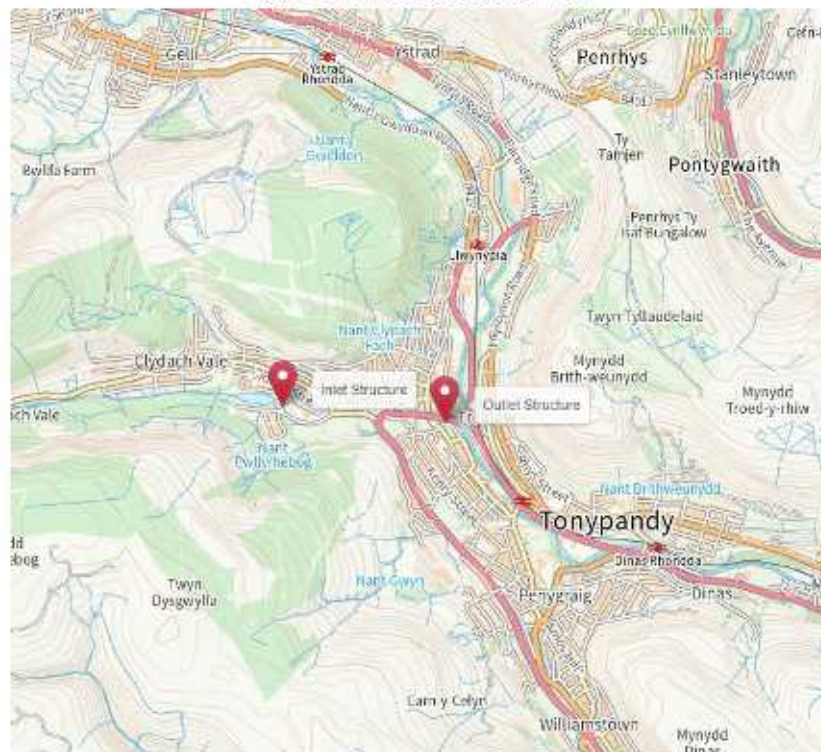



Figure 2: Structure Location Plan

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2 Description of Structure

2.1 General Description

Cwm Clydach Culvert consists of multiple structural forms as detailed below, carrying Nant Clydach under the A4119. The date of construction is unknown.

2.2 Form of Construction

In the tables below, chainage is measured from the inlet at the north-western side of the structure.

Table 1.1: Form of Element Construction: Span 1 – Inlet to CH54.5m

Structural Element	Form of Construction
Chainage	0m – 54.5m (from inlet)
Primary Deck	Pre-cast concrete box sections, measuring 3m wide and 2.2m high. Concrete steps to the right and left, with a central channel measuring 1.15m wide.
Secondary Deck	N/A
Abutments	Integral precast concrete box sections.
Invert	Concrete steps to the right and left, with a central channel measuring 1.15m wide.
Section Dimensions	3m wide and 2.2m high
Intermediate Supports	N/A
Headwalls and Wing Walls	Stone masonry inlet structure.
Bearings and Articulation	N/A
Deck Ancillaries	N/A
Protective Systems	N/A
Permanent Access Equipment	Galvanised steel trash screen covering the inlet, with an access hatch to the top of the screen, secured by M16 bolt assembly (24mm spanner and socket required for access). No step irons, ladder with tripod and fall arrest/recovery winch utilised for safe access and egress.



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Table 1.2: Form of Element Construction: Span 2 – CH54.5m

Structural Element	Form of Construction
Chainage	54.5m (from inlet)
Primary Deck	Cast in situ concrete pipe, circa 2.75m internal diameter with concrete aprons to the right and left of the invert.
Secondary Deck	N/A
Abutments	N/A
Invert	Concrete channel, with aprons to the right and left
Section Dimensions	Circa 2.75m internal diameter
Intermediate Supports	N/A
Headwalls and Wing Walls	N/A
Bearings and Articulation	N/A
Deck Ancillaries	N/A
Protective Systems	N/A
Permanent Access Equipment	

Table 1.3: Form of Element Construction: Span 3 – Outlet to CH68m

Structural Element	Form of Construction
Chainage	0m – 68m (from outlet)
Primary Deck	2.75m internal diameter engineering brick barrel, with a formed steel pipe invert, measuring 1.55m wide and concrete aprons to the right and left.
Secondary Deck	N/A
Abutments	N/A
Invert	Formed steel pipe invert, measuring 1.55m wide and concrete aprons to the right and left.
Section Dimensions	2.75m wide and 2.23m high (due to invert pipework)
Intermediate Supports	N/A
Headwalls and Wing Walls	Stone masonry headwall at the outlet
Bearings and Articulation	N/A
Deck Ancillaries	N/A
Protective Systems	N/A
Permanent Access Equipment	N/A

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3 Description of Inspection

3.1 Previous Inspection

The most recent inspection was carried out utilising a CCTV system, which was abandoned due to waterflows within the structure.

3.2 Details of Inspection

Table 2: Inspection Details

Inspection team	Simeon Davies	Kyle Bugler	
	Richard Harris	Samuel Preece	
	Jack Constable		
Report by:	Simeon Davies		
Inspection date	10 th March 2022		
Report No.	A8633.01		

3.2.1 Objective

Edwards Diving Services Ltd. (EDS) was commissioned by Arup to carry out a dimensional and construction survey of Cwm Clydach Culvert, to aid with hydraulic modelling of the Clydach watercourse. The objective of the inspection was to provide information on the physical construction of all inspectable elements of Cwm Clydach Culvert, inclusive of any deviations in the line of the culvert. This report has been prepared in accordance with the DMRB (BD 63/17), the Inspection Manual for Highway Structures, 2007 and the Welsh Government Inspection Manual, 2015. A BCI form has been completed in accordance with the Addendum to CSS Guidance Note on Bridge Condition Indicators, 2004.

3.2.2 Site conditions


Weather conditions on the day of the inspection were dry and overcast. The watercourse flow upstream and downstream of the structure were low, however, due to the gradient on which the culvert has been constructed, the flow within the culvert was high, preventing access into the main flow of the water.

3.2.3 Access

The inspection was carried out by a 5-man confined space team in accordance with The Confined Space Regulations, 1997. Access to the culvert was gained via the culvert inlet located at grid reference SS 98336 92776, aided by a ladder, tripod, winch and fall arrest. Access to the culvert outlet, located at grid reference SS 99306 92685, was gained via the adjacent embankments. Traffic Management was not required for this inspection.

4 Inspection Report

Photographs referenced within the tables below (see column entitled 'P') can be found in Appendix A; severity (S), extent (Ex) and work required (W) codes as per The Welsh Government Inspection Manual 2015, summarised in Appendix B. Numbered references in the column entitled 'Ref.' cross-

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refer to the numbered areas of concern and recommendations (see sections 7.1 and 7.2 respectively).

Chainage datum was taken at the culvert inlet and reset to be inspected from the culvert outlet. Reference to the directions left/right are to be taken looking downstream.

Culvert Inlet

The culvert commences as concrete box sections, on a steep gradient. All water is currently funnelled through a 1.15m wide concrete channel. The gradient of the culvert increases the velocity of the water, this did not affect the working party for the length of span 1, due to the presence of the steps to the right and left of the culvert, which were dry at the time of the inspection.

At the base of the incline, there was infiltration with leachate, this had led to the apron being slippery underfoot. Access passed the base of the incline was not possible due to the increased risk of slips, with fast flowing water within the main channel.

Downstream of the incline, the culvert started on a constant curve to the left, appearing to pass through approximately 90 degrees.


Culvert Outlet

At the outlet, the structure consists of a 2.75m diameter engineering brick barrel; the invert consists of half steel pipe sections, with cast in situ concrete aprons to the right and left. There is a steel main, measuring 250mm O.D., travelling along the left apron, looking upstream.

The flow was concentrated to the centre of the invert, which was a high velocity, likely due to the gradient of the structure upstream. This prevented access into the channel of water, due to the risk of slips.

4.1.1 Uninspected areas

The flow within the structure prevented access through, due to the inability to walk within the channel of water. The fast flow prevented a firm footing, with a high possibility of a fall risk to the inspectors.

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5 Discussion

5.1 Condition Statement

Cwm Clydach Culvert was found to be in a fair condition; no significant defects were identified; however, access was significantly restricted due to the velocity of water. The inspection was conducted following a relatively dry period of weather, with the flows upstream and downstream of the structure, relatively low. The gradient at the upstream increased the velocity of the water, preventing safe access from either the upstream or downstream elevation.

5.2 Recommendations

Due to the conditions experienced during the inspection, it would be recommended to conduct the inspection during the summer months, where there is the potential for the flows to be considerably lower. The structure is fed by a lake, with the overflow from the lake discharging into the culvert, it is not known if the flows would significantly reduce during summer months, however, it would provide the greatest possibility of low flows through the culvert.

The pre-inspection works, indicated significant gradients through the culvert, it is not currently known, that even with a reduced flow, if the structures would be fully accessible.

Locating the inspection chambers on the surface and entering each, attached to a tripod and winch, would enable the team to identify the potential gradients and enable a safe method for inspection to be formulated dependant on the findings.

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Appendix A: Inspection Photographs



Photo 1 – Upstream elevation



Photo 2 –View downstream from the structure inlet


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Photo 3 – View upstream from the structure inlet



Photo 4 – General view downstream through span 1


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Photo 5 – General view upstream of span 1, taken from Ch54.5m



Photo 6 – View of the change in construction to span 2 (CH54.5m)


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Photo 7 – View through span 2, looking downstream from Ch54.5m)



Photo 8 – General view of the culvert outlet


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Photo 9 – View downstream from the culvert outlet



Photo 10 – View upstream of the culvert outlet


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Photo 11 – General view through span 3, looking upstream



Photo 12 – Example of the cast in situ concrete repairs to the arch


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Photo 13 – General view through the cast in situ concrete arch repair sections



Photo 14 – General view up from the termination point.